

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicant : LAM, Tony M.
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Examiner : JACYNA, J. Casimer
For : WELLHEAD PRODUCTION BLOWOUT PREVENTER
Docket No.: 73-03
Customer No.: 23713

CERTIFICATE OF EFS-WEB FILING

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June 19, 2006 /bkroge/
Date B. Kroge

MAIL STOP AMENDMENT
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO OFFICE ACTION

Sir:

In response to the Office Action dated February 17, 2006, please enter the following response.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 12 of this paper.

Amendments to the Claims:

The listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Original) A ram for use in the horizontal bore of a wellhead production blowout preventer to close off the vertical bore of the well, said ram having front and rear ends, a longitudinal axis and being adapted to seal at its front end against either a polish rod of a rod string or an adjacent ram, said ram comprising:

a body component with front and rear portions and ends;

a seal component with front and rear portions and ends;

said body component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and having a cut-out in its front portion which provides a seal support surface to support the seal component in both a vertical and horizontal direction;

said seal component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and an inner surface which generally conforms to the seal support surface of the body component;

said body component and seal component combining, in an assembled form, to form a full bore ram body, which when out of sealing engagement has the front end of the seal component protruding a horizontal distance d beyond the front end of the body component;

connectors for connecting the seal and body components while allowing the seal component, during sealing engagement, to be pressed against the seal support surface of the body component; and

said seal component providing a sealing surface formed of thermoplastic material around the arcuate outer surface for sealing against the horizontal bore;

so that, as the body component is advanced forwardly into a sealing engagement causing the front end of the seal component to contact either the adjacent ram or the polish rod to seal off the vertical bore, the seal component is pressed against the seal support surface of the body component such that the thermoplastic sealing surface is compressed

outwardly to seal against the horizontal bore.

2. (Original) The ram of claim 1, wherein the thermoplastic sealing surface of the seal component includes a raised ridge sealing surface formed of thermoplastic material around the arcuate outer surface for sealing against the horizontal bore.

3. (Original) The ram of claim 2, wherein the raised ridge sealing surface includes one or both of a peripheral raised ridge sealing surface located at the peripheral edges of the seal component adjacent the body component, or a vertical bore raised ridge sealing surface located at the front end of the seal component in the area which is exposed to the vertical bore when in a sealing engagement.

4. (Original) The ram of claim 3, wherein the seal component is formed from a thermoplastic material and wherein the vertical bore raised ridge sealing surface, if present, is either preformed by forming a reduced radius portion on the outer arcuate surface of the seal component, or by forming the raised ridge sealing surface in situ by sealing the ram against the vertical bore.

5. (Original) The ram of claim 4, wherein the seal component is formed of thermoplastic material, and wherein the peripheral raised ridge sealing surface, if present, is formed by forming a reduced radius portion on the outer arcuate surface of the seal component to form the peripheral raised ridge surface at its peripheral edges adjacent the body component.

6. (Withdrawn) The ram of claim 1, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped, said seal support surface having a horizontal support surface which is generally parallel to the horizontal axis of the ram, and a rear support surface which is rearwardly inclined relative to the vertical, such that in sealing engagement, the seal component is pressed against the horizontal and rear support surfaces so as to compress the thermoplastic sealing surface

outwardly against the horizontal bore.

7. (Withdrawn) The ram of claim 4, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped, said seal support surface having a horizontal support surface which is generally parallel to the horizontal axis of the ram, and a rear support surface which is rearwardly inclined relative to the vertical, such that in sealing engagement, the seal component is pressed against the horizontal and rear support surfaces so as to compress the thermoplastic sealing surface outwardly against the horizontal bore.

8. (Original) The ram of claim 1, wherein the seal support surface of the body component forms an acutely angled surface, relative to its longitudinal axis, against which the seal component is pressed during sealing engagement to seal off the vertical and horizontal bores.

9. (Original) The ram of claim 4, wherein the seal support surface of the body component forms an acutely angled surface, relative to its longitudinal axis, against which the seal component is pressed during sealing engagement to seal off the vertical and horizontal bores.

10. (Withdrawn) The ram of claim 9, wherein the seal component and the cut-out portion of the body component are both generally wedge shaped, with the wide end of the wedge shaped seal component being the front end.

11. (Original) The ram of claim 1, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped.

12. (Withdrawn) The ram of claim 7, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped.

13. (Withdrawn) The ram of claim 12, wherein the L-shaped seal support surface of the

body component forms an acutely angled surface, relative to its longitudinal axis; wherein the body component and seal component, when combined in the assembled form, form a gap, whose horizontal width is less than d , between the seal and body components at the rear end of the seal component, and wherein the L-shaped inner surface of the seal component is adapted to ride upwardly and rearwardly on the acutely angled surface of the body component during sealing engagement to close the gap and to compress the seal component outwardly to seal against the horizontal bore.

14. (Withdrawn) The ram of claim 12, wherein the seal component is formed in two parts, a steel ram insert forming a groove at its front end and its peripheral edges adjacent the body component, and a thermoplastic seal insert held in the groove, said thermoplastic seal insert forming the peripheral raised ridge sealing surface.

15. (Withdrawn) The ram of claim 13, wherein the seal component is formed in two parts, a lower steel wedge portion and an upper thermoplastic seal portion, which are connected together with connectors to form the seal component, and wherein the lower wedge portion forms the angled surface at its lower surface which rides on the angled surface of the body component.

16. (Withdrawn) The ram of claim 14, wherein the seal component is formed in two parts, a lower steel wedge portion and an upper thermoplastic seal portion, which are connected together with connectors to form the seal component, and wherein the lower wedge portion forms the angled surface at its lower surface which rides on the angled surface of the body component.

17. (Withdrawn) The ram of claim 13, wherein the body component is formed in two parts, a rear plate portion and a front wedge portion, which are connected together with connectors to form the L-shaped body component.

18. (Withdrawn) The ram of claim 14, wherein the body component is formed in two

parts, a rear plate portion and a front wedge portion, which are connected together with connectors to form the L-shaped body component.

19. (Withdrawn) The ram of claim 15, wherein the body component is formed in two parts, a rear plate portion and a front wedge portion, which are connected together with connectors to form the L-shaped body component.

20. (Withdrawn) The ram of claim 1, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

21. (Withdrawn) The ram of claim 7, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

22. (Withdrawn) The ram of claim 9, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

23. (Withdrawn) The ram of claim 10, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

24. (Withdrawn) The ram of claim 12, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a

reduced area of the sealing face forms the seal.

25. (Withdrawn) The ram of claim 13, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

26. (Withdrawn) The ram of claim 14, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

27. (Withdrawn) The ram of claim 16, wherein the front end of the seal component provides a sealing face to seal against either the polish rod or the sealing face of an opposing ram, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

28. (Withdrawn) The ram of claim 1, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

29. (Withdrawn) The ram of claim 7, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

30. (Withdrawn) The ram of claim 9, wherein the front portion of the body component is

generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

31. (Withdrawn) The ram of claim 10, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

32. (Withdrawn) The ram of claim 12, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

33. (Withdrawn) The ram of claim 13, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

34. (Withdrawn) The ram of claim 14, wherein the front portion of the body component is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

35. (Withdrawn) The ram of claim 16, wherein the front portion of the body component

is generally T-shaped with two cut-outs providing two seal support surfaces, and wherein the ram includes two seal components, each adapted to be pressed against one of the seal support surfaces during sealing engagement and each having the front end protruding beyond the front end of the body component.

36. (Original) The ram of claim 1, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

37. (Withdrawn) The ram of claim 7, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

38. (Original) The ram of claim 9, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

39. (Withdrawn) The ram of claim 10, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

40. (Withdrawn) The ram of claim 12, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

41. (Withdrawn) The ram of claim 13, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

42. (Withdrawn) The ram of claim 14, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

43. (Withdrawn) The ram of claim 16, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

44. (Original) A production blowout preventer, comprising:

a housing forming a vertical bore extending longitudinally therethrough and a pair of coaxial horizontal ram bores, each having a longitudinal axis and a horizontal bore surface, extending transversely thereof, and intersecting the vertical bore;

a pair of rams positioned in the ram bores, each ram having front and rear ends, the rams being slidable along the ram bores so as to project into the vertical bore where their front ends may seal either against each other or against a polish rod of a rod string extending therethrough; and

means for advancing and withdrawing the rams between sealing and open positions; each ram comprising:

a body component with front and rear portions and ends;

a seal component with front and rear portions and ends;

said body component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and having a cut-out in its front portion which provides a seal support surface to support the seal component in both a vertical and horizontal direction;

said seal component having an arcuate longitudinal outer surface for conforming with the horizontal bore surface, and an inner surface which generally conforms to the seal support surface of the body component;

said body component and seal component combining, in an assembled form, to form a full bore ram body, which when out of sealing engagement has the front end of the seal component protruding a horizontal distance d beyond the front end of the body component;

connectors for connecting the seal and body components while allowing the seal component, during sealing engagement, to be pressed against the seal support surface of the body component; and

said seal component providing a sealing surface formed of thermoplastic material around the arcuate outer surface for sealing against the horizontal bore;

so that, as the body component is advanced forwardly into a sealing engagement causing the front end of the seal component to contact either the adjacent ram or the polish rod to seal off the vertical bore, the seal component is pressed against the seal support surface of the body component such that the thermoplastic sealing surface is compressed

outwardly to seal against the horizontal bore.

45. (New) The ram of claim 5, wherein the seal support surface of the body component and the inner surface of the seal component are both generally L-shaped.

46. (New) The ram of claim 45, wherein the L-shaped seal support surface of the body component forms an acutely angled surface, relative to its longitudinal axis; wherein the body component and seal component, when combined in the assembled form, form a gap, whose horizontal width is less than d , between the seal and body components at the rear end of the seal component, and wherein the L-shaped inner surface of the seal component is adapted to ride upwardly and rearwardly on the acutely angled surface of the body component during sealing engagement to close the gap and to compress the seal component outwardly to seal against the horizontal bore.

47. (New) The ram of claim 46, wherein the seal and body components are formed with a vertical radial groove at their front edges to accommodate the polish rod.

48. (New) The ram of claim 47, wherein the seal component includes the vertical raised ridge sealing surface formed in situ by sealing the ram against the vertical bore.

49. (New) The ram of claim 46, wherein the front end of the seal component provides a sealing face to seal against the polish rod, and wherein the sealing face includes a cut-away portion such that a reduced area of the sealing face forms the seal.

REMARKS

Original claims 1 - 44 are pending in this application, with claims 1-5, 8, 9, 11, 36, 38 and 44 being under consideration. Claims 6, 7, 10, 12-25, 37, and 39-43, according to the last Office Action, are considered as if they are withdrawn, due to the species election of the last response. However, as Applicant understands, these claims still form part of the claims and will be reconsidered once an allowable generic claim is found to exist.

New claims 45 - 49 are added in this Amendment. These claims are believed to find support in the original application and original claims as follows. Claim 45 is identical to original claim 12, but is dependent on claim 5. Claim 46 is identical to original claim 13, but is dependent on claim 45. Claim 47 is identical to original claim 36, but is dependent on claim 46. Claim 48 depends on claim 47, and defines the feature of the vertical bore raised ridge of claim 4 as being formed in situ. Claim 49 adds the feature of claim 20, but is dependent on claim 48. Each of the features now defined in claims 45 - 48 are shown in the embodiment of Figures 1 - 5, and thus these claims should now be examined along with claims 1-5, 8, 9, 11, 36, 38 and 44 now under consideration. Claim 49 refers to the feature of the reduced surface area of the sealing front sealing face of the ram, a feature shown, for example in Figure 28. Thus claim 49, while being properly supported, should join the withdrawn claims not under consideration until an allowable generic claim is found to exist.

I. Election of Species

The Office Action maintains the previous restriction requirement, making the requirement final. The Office Action notes that, until proven to be linked by a generic claim entered in this case, they will continue to be considered as independent inventions and restricted. As set out below, and without acquiescing to this rejection, Applicant respectfully submits that claim 1 is (a) generic to all claims, including the restricted claims and the new claims, and (b) allowable. Thus, once allowance of claim 1 is confirmed, Applicant respectfully requests favourable reconsideration and allowance of all of the claims, including the restricted claims 6, 7, 10, 12-25, 37 and 39-43, and the new claims 45 - 49.

II. Claims Rejection - 35 USC § 102(b)

The Office Action rejects claims 1-5, 8, 9 11, 36, 38, and 44 under 35 USC § 102(b) as having been anticipated by Rector (U.S. Patent No. 2,593,793), and states:

Rector discloses a ram including a body 33, a seal 56, an arcuate surface for body and seal 37, 46, 52, horizontal and vertical seal supports in front of 57 below 55, 43, and 58, a protruding portion of the seal at 42, 52 as shown in figures 2 and 4, connectors 41, 47, and (see claim 8) an angled surface at the rear of 49.

Applicant respectfully traverses this rejection for the reasons to follow.

Before dealing with this rejection, it is worthwhile to summarize Applicant's claimed invention, since there are multiple features present in claim 1 which are missing from the Rector patent. At page 2, Applicant points out difficulties with prior art blowout preventor (BOP) rams which include elastomeric, typically nitrile rubber seals. Pressure from below extrudes the rubber so that the seal is lost. The rubber may tear loose from the core under high pressure, so again, the seal is lost. In severe conditions, such as when injecting chemicals, the rubber degrades quickly, and the seals can fail. As pointed out at page 4, while the properties of thermoplastic seal materials make them desirable for use in harsh sealing environments, the inventor discovered during testing that simple substitution of thermoplastic materials into prior art BOP ram designs did not work.

As set out in claim 1, the BOP ram of this invention includes two main parts - a body component which supports a seal component, along with connectors. The seal and body components, when assembled, form a full bore ram body. Importantly, the seal component provides a sealing surface formed of thermoplastic material around its arcuate outer surface for sealing against the horizontal bore. As well, the front end of the seal component protrudes beyond the front end of the body component (when not in sealing engagement). Connectors between the seal and body components allow the seal

component, during sealing engagement, to be pressed against the support surface of the body component. In this way, when the body component is advanced into sealing engagement, the protruding front ends of the seal component contact each other and/or the polish rod, and the seal component is pressed against the support surface of the body component, causing the thermoplastic sealing surface to be compressed outwardly to seal against the horizontal bore. This thus provides a thermoplastic seal both at the front end of the rams, and to the horizontal bore.

Turning to Rector, it should first be noted that Rector is in no way concerned with forming a thermoplastic seal in a BOP ram. He provides a packing member 42 which is sandwiched and immobilised between two steel ram body components. However, the packer is not made of thermoplastic material. At col. 3, lines 56 - 60, the packing member is described as being of reinforced rubber, or other suitable material. These are clearly the known prior art nitrile rubber based materials which are prone to extrusion etc., as set out above. At the 1947 date of the Rector patent, to Applicant's knowledge, no thermoplastic materials were even thought of for BOP devices, so there is no suggestion within the reference to substitute such materials, or to include them within the "or other suitable material" phrase of Rector. Thus, Rector's device is clearly directed at provision of a ram seal which will limit extrusion of the rubber packing member. For this purpose, as best shown in Figure 4, both the upper steel body component, and the packing member extend beyond the front of the ram. Furthermore, the packer is anchored in place on the steel body in Rector (see items 58, 49), so the packing member does not move relative to the steel body parts. To form a seal with Rector's ram, the packing member is squeezed outwardly when the body components are initially bolted together.

This is a different sealing action and structure from the type of seal that is claimed in Applicant's device, which seals only when the rams are advanced into sealing engagement. The seal component in Applicant's device, according to claim 1 (and all other claims) forms a sealing surface of thermoplastic material around the arcuate outer surface of the seal component, for sealing against the horizontal bore. Not only is Rector missing this

thermoplastic sealing surface, but Rector's seal, with elastomeric materials, cannot seal in the manner of Applicant's thermoplastic seal. To produce Applicant's seal, the connectors, body component, and seal component with front end protruding past the body component, all cooperate in sealing engagement, with the protruding front ends of the seal components pressing against each other and/or the polish rod, the connectors allowing the seal component to press against the support surface of the body component, and the thermoplastic sealing surface being compressed outwardly to seal against the horizontal bore. Thus, these pressing actions cause some movement of the seal component thermoplastic seal surface as a result of the structure and pressing actions. This movement is allowed for by the connectors. This is in sharp contrast to Rector's rubber seal, which cannot move as a unit, due to the items 58, 49, and due to its rubber composition and different properties. An elastomeric seal of rubber must initially be squeezed into place by the steel body components to form a seal.

Thus, not only is Rector's device missing the multiple of Applicant's claim 1 features underlined above, it cannot form a seal by mere substitution of a thermoplastic material for the rubber specified by Rector. This is due to the vastly different properties of rubber and thermoplastic materials, as outlined above.

Favourable reconsideration and allowance of claim 1, and all remaining claims which depend on claim 1, are hereby respectfully requested. The same claim language appears in independent claim 44, for the rams within a blowout preventer. Thus, favourable consideration and allowance of this claim is also respectfully requested.

The Office Action also rejects claims 1-5, 11, 36, and 44 under 35 USC § 102(b) as having been anticipated by Lee, Jr. (U.S. Patent No. 5,833,208), and states:

Lee discloses a ram including a body 22, a seal 23, an arcuate surface for body and seal at 30, horizontal and vertical seal supports 31, 34, a protruding portion of the seal at 52 as shown in figures 2 and 4 and connectors 54, 56.

Applicant respectfully traverses this rejection. The BOP of Lee is not seen to be relevant at all to Applicant's claims. It is a different type of BOP, making no provision for sealing against the horizontal ram bores, a feature clearly set out in broad claims 1 and 44 of this application. As mentioned in the background of the Lee patent, his type of BOP device is used to seal against a drill pipe. While there are some common features in BOP rams of this type, because the well is not generally in production during drilling, the BOP rams themselves do not necessarily seal against the horizontal ram bores. The Lee patent does make mention of the use of thermoplastic materials, but this is only for the front seal between the ram and the drill pipe. The entire teaching of Lee, in respect of thermoplastic seals is found at col. 4, lines 45 - 47: "Insert 23 may be formed of various resilient materials which have desired wear characteristics such as thermoplastic materials." Clearly, there is no provision in Lee for a thermoplastic sealing surface positioned at the arcuate outer surface of a seal component, which is pressed into sealing engagement by compressing outwardly to seal against the horizontal bore. This structure and sealing action, all of which is present in broad claims 1 and 44 of Applicant's application, is totally missing from the Lee patent

In view of the above, Applicant respectfully traverses this novelty rejection based on the Lee patent, and requests the Examiner to withdraw the rejection of claims 1 and 44, together with all of the remaining claims which depend from claim 1.

III. Conclusion

In view of the foregoing, it is submitted that claim 1 is in condition for allowance, and is a generic claim for all other dependent claims of this application. Thus Applicant believes the restriction of claims 6, 7, 10, 12-15, 37 and 39-43 should be withdrawn and all claims considered. Claim 1 is also believed to be generic for new claims 45 - 49. Consequentially, Applicant respectfully requests the withdrawal of all rejections for this application, coupled with a Notice of Allowance.

This response is accompanied by a one month extension of time which authorizes the charge of \$120.00 to Deposit Account No. 07-1969. However, if this amount is incorrect, please deduct the appropriate fee for this submission from Deposit Account No. 07-1969.

Respectfully submitted,
/michaeljcurtis/

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